

Teacher and Technician Sheet

In this practical students will:

- Carry out and carefully observe the results of the practical.
- Use their knowledge of **emulsions**, **mixtures** and **surface tension** to explain observations.
- (Extra)- Observe the results of the demonstration- drawing links between carmine's colour change, temperature and the amount of oxygen dissolved in a solution.

Introduction:

This investigation looks at the topic of surface tension in a colourful way.

Introduce the investigation by talking about and show what happens when flour is placed onto the surface of water.

Extend that to looking at photographs of water skaters and the dip at each point where the legs touch the water.

Discuss what they think is happening.

During the discussion explain that milk is made of oil and water and in that oil is hydrophobic in nature (it repels water). Introduce the fact that food colouring mixes with water to form a coloured solution.

These discussions can be as pairs leading to a group discussion or as a whole class discussion. Pairs talk first and then sharing their ideas does allow more students the opportunity to engage.

Curriculum range:

Secondary age students but can be done with Primary pupils to investigate materials: It links with:

- reporting on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions;
- using straightforward scientific evidence to answer questions or to support their findings;
- comparing and grouping together everyday materials on the basis of their properties;
- knowing and show that some materials will mix, while others will not but physical properties of substances can create changes;



- building a more systematic understanding of materials by exploring and comparing the properties of a broad range of materials.

Hazard warnings:

There are no hazards with this investigation but there is a warning that some food colourings can stain the skin and some children can have milk intolerance so it is advisable to check first. To prevent the staining of the skin by colourings it is advisable to give the children disposable plastic gloves to wear.

Equipment:

- 1 clean shallow tray, 30 cm x 20 cm
- 1 litre each of different types of milk
- 100 cm³ water
- 10 cm³ good quality washing-up liquid
- 1 bottle each of red, blue, green and yellow food colourings
- 5 eyedroppers, 1 for each of the colourings and 1 for the washing-up liquid solution
- 1 beaker (100 cm³)
- 1 stirring rod
- 2 cotton buds

Going further:

The Traffic Light reaction

For secondary students this is a good example of a redox reaction in which a compound is reduced and with each change it changes colour.

Hazard warnings:

Sodium hydroxide is CORROSIVE.

It will also generate heat so the teacher will need to be careful when dissolving the sodium hydroxide. (Boiling can occur when the solid is added to water.)

Indigo carmine (E132) is an IRRITANT to the eyes, respiratory system and skin.

Use a fume cupboard.

Wear safety goggles (BS EN166 3) and disposable nitrile gloves.

Students should wear safety glasses to observe the demonstration.



Materials:

- 2 beakers (1 dm³)
- 1 beaker (500 cm³)
- 1 stirring rod
- 750 cm³ warm water ~ 60 °C from a kettle
- Distilled water
- Thermometer
- 2 top pan balance
- 3 weighing boats
- 3 spatulas
- 12 g glucose
- 250 cm³ of 0.5 M sodium hydroxide solution
- 0.04 g indigo carmine indicator (E132)
- Access to a kettle

Method:

1. Use a kettle to heat up 750 cm³ of water to just above 60 °C.
2. Pour the warm water into one of the 1 dm³ beakers and add cold water to bring the water to 60 °C.
3. Add 12 g of glucose to the warm water.
4. Stir to dissolve the glucose in the water.
5. Carefully weigh out and then add 0.4 g of indigo carmine indicator to the warm glucose solution.
6. Stir until the solution is dark blue.
7. Carefully and slowly pour the sodium hydroxide solution into the glucose/indicator solution and watch what happens.
8. Now pour the whole solution slowly, from a height, of 10 cm into the other 1 dm³ beaker and watch what happens.
 - Describe what happens to the solution.



Technical notes:

Only the technician, teacher or Year 12 can prepare sodium hydroxide solution from the solid because it's corrosive and the reaction is exothermic (enough to cause the liquid to boil).

Students could use ready prepared solutions of indigo carmine (E132).

2 pipettes (approx. 4-5 cm³) of the indigo carmine solution could be used for the practical instead of the solid.

Disposable plates could be used instead of trays (with a reduced amount of milk used).

Results:

This is an easy practical to provide and use for primary or higher key stage students.

This gives great results of colour bursts due to the bipolar characteristics of the washing-up liquid.

It should consolidate the students learning from the 'Making an oil/water emulsion' experiment and the explanations of the hydrophilic and hydrophobic polarity of substances.

There is an interesting effect of temperature. At room temperature, the dye changes from yellow to green on pouring and then changes back over about 90 – 120 seconds through red to yellow. (The first change is rather slow though).

When warm though, the indigo carmine will change from yellow to red and then back quite quickly.

The red and green forms are differently oxidised states and the green is the more oxidised. Hot water can dissolve less oxygen so at higher temperatures there is not enough water to create the more highly oxidised green state.

